



FLIGHT SIMULATOR DISPLAY SYSTEMS



REDIFFUSION
Simulation

Unrivalled realism in flight training

Once in a while a truly revolutionary product appears that changes the entire perception of how things have been done in the past.

WIDE is just such a product.

Launched in 1981, WIDE genuinely moved flight simulation forward a generation by displaying, for the first time, computer generated scenes of the outside world through a continuous, uninterrupted field-of-view.

In doing so it transformed instantly the overall realism of the simulated training environment, as well as its relevance across a very broad spread of both civil and military flight training.

Now, with the addition of SupraWIDE, that relevance is even greater. SupraWIDE uses advanced new CRT technology to provide substantial performance improvements which materialise, at the pilot's eye, as better picture sharpness, contrast and resolution.

In product terms, WIDE has been totally successful both in gaining pilot acceptance and in achieving international regulatory credits, including FAA Phase II.

So successful, in fact, that systems are now in service throughout the world in a very wide range of training and research applications.

As originally designed, WIDE creates a continuous field-of-view that extends 150° horizontally by 40° vertically. In its WIDE II form, introduced in 1983 to meet the very special requirements associated with mission oriented military helicopter training, the field-of-view has been extended to allow a massive 200° of continuous, horizontal vision.

Remarkably, WIDE remains unique in the flight simulator industry and, despite competitive claims, is the only system of its type either to have entered service or even to have been operationally demonstrated.

With SupraWIDE Rediffusion has underlined its commitment to remaining out in front in this innovative technology.

SupraWIDE is much more than a logical development step in the product lifecycle – it represents an uplift in performance that will ultimately benefit the overall training environment. CGI scenes are presented with greater sharpness and contrast than has previously been the case and, most importantly, with a far greater consistency of resolution across the entire display – from the centre to the extreme picture boundaries.

What this means operationally is that, for a relatively small cost increment, greater advantage maybe taken from today's very realistic computer generated imagery. That translates directly into even better pilot acceptance, a higher transfer of training and the potential to meet even more demanding regulatory requirements.

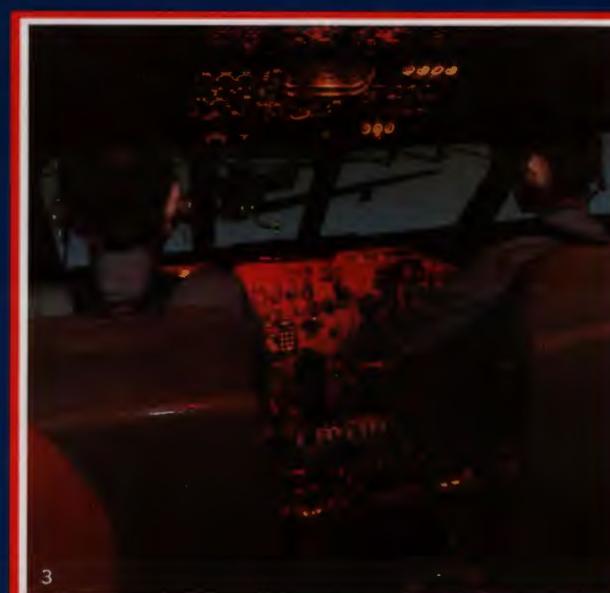
So, the WIDE range now spans the entire spectrum of operational and regulatory training needs.

As a display media, all WIDE systems are compatible with current and proposed Rediffusion image generation technology and have been designed for integration with virtually all large scale flight simulators.

In a very short space of time WIDE has established a new technology standard that not only improves the quality of flight training but, which also differentiates Rediffusion as the leading innovator in a technologically competitive business.

Cover: Daylight runway scene on Alitalia Super 80 flight simulator.

1. SupraWIDE display on Japan Air Lines B767 simulator. With Novoview SP3/T visuals this simulator has received JCAB certification.
2. SupraWIDE approach on BAe 146 simulator using Novoview SP3/T image generation system.
3. Novoview SP1 scene displayed to RAF VC10 flight deck.
4. Novoview SP1 night approach to an oil platform from BAH Chinook helicopter simulator.
5. WIDE II provides a 200° field of view and uses SupraWIDE projectors. The first application is the Royal Navy Sea King simulator.



Display technology to meet all training criteria

Since 1983 Rediffusion has received both a British Design Council award and a Queen's Award for Technological Achievement for the design, development and implementation of its WIDE display system.

These awards, whilst prestigious, underline the important contribution that WIDE has made to the evolution of the modern flight simulator.

Until WIDE, CGI scenes conventionally were displayed to pilots using monitor based modules mounted around the individual cockpit windows. This technique, whilst meeting current regulatory requirements, has a number of inherent optical limitations and remains fundamentally removed from the real world.

WIDE totally overcomes these limitations.

In its basic form WIDE uses three specially designed Rediffusion calligraphic projectors, mounted above the simulator cab, projecting an image onto a back projection screen. The image so formed is viewed by the occupants of the flight deck from a single piece collimating mirror extending around the entire flight deck structure. This creates a $150^\circ \times 40^\circ$ field-of-view in which the vertical element is normally distributed as 20° above and 20° below the horizon. To meet specific requirements, however, this may be reconfigured to give greater upward vision for applications such as inflight refuelling, or greater downward vision for ground related training exercises.

In extending the WIDE product range to encompass SupraWIDE, Rediffusion has taken advantage of new CRT technology to provide greater performance for those operators requiring higher overall resolution and picture quality. The important difference between the two

systems is in the design of the new projector tubes which have been developed, from the outset, specifically for the flight simulation task.

The phosphor target for instance, on which the picture is first created, has been enlarged by around 35% to provide a corresponding improvement in spot size and light point resolution at the centre of each channel. At the same time, substantial advances in optical design have resulted in the incorporation of a twin element lens producing a far greater consistency of resolution across each channel and, in particular, improved sharpness at the picture edges. The tube also has been mechanically redesigned, so that it can be produced with greater precision, whilst the reduction in the number of internal components increases optical efficiency. Finally, with the enlarged target requiring less beam density, tube life has been substantially extended.

Basic WIDE systems, or existing systems in the field, may be efficiently and cost effectively upgraded to SupraWIDE specification simply by a change of tubes and minor electronic components.

Completing the range is WIDE II which uses five projectors to create a continuous 200° field of horizontal vision and which incorporates the advanced new tube design in its projectors. WIDE II has been specified for a number of specialised training applications in both Europe and the United States.

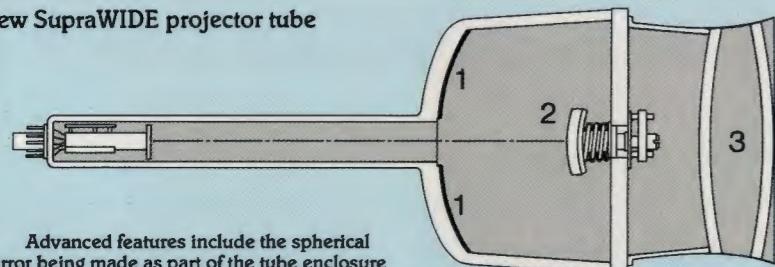
1. WIDE system showing the relationship between projectors, back projection screen, flight deck and mirror.

2. WIDE creates a 40° vertical field of view.

3. Three projector WIDE creates a continuous 150° horizontal field of view.

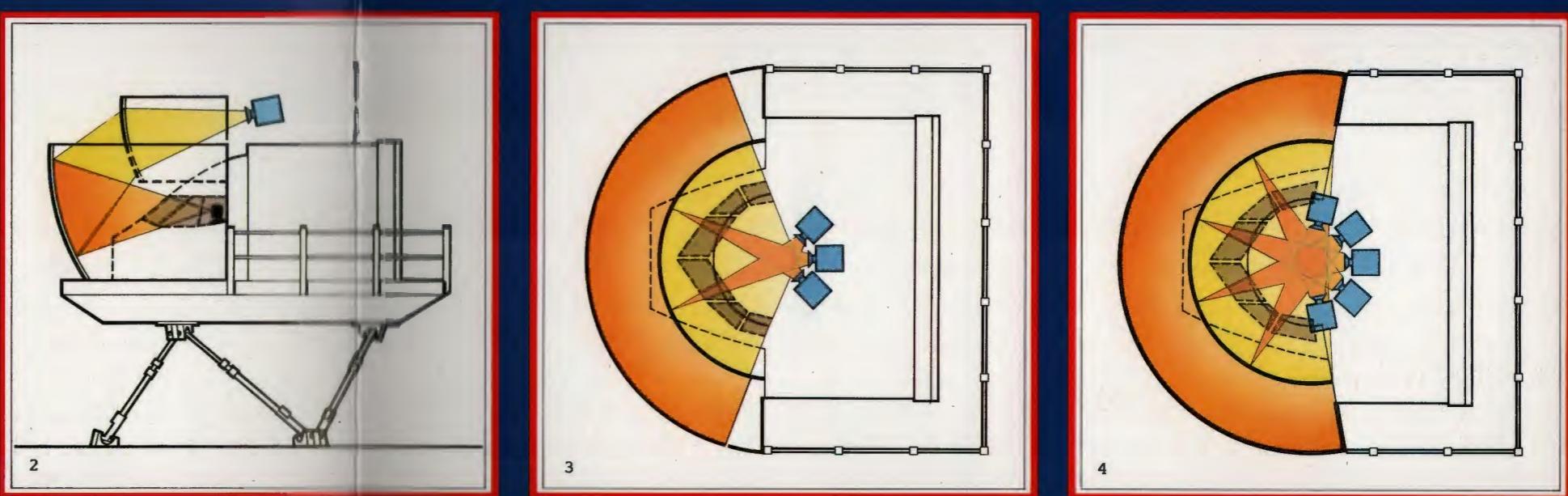
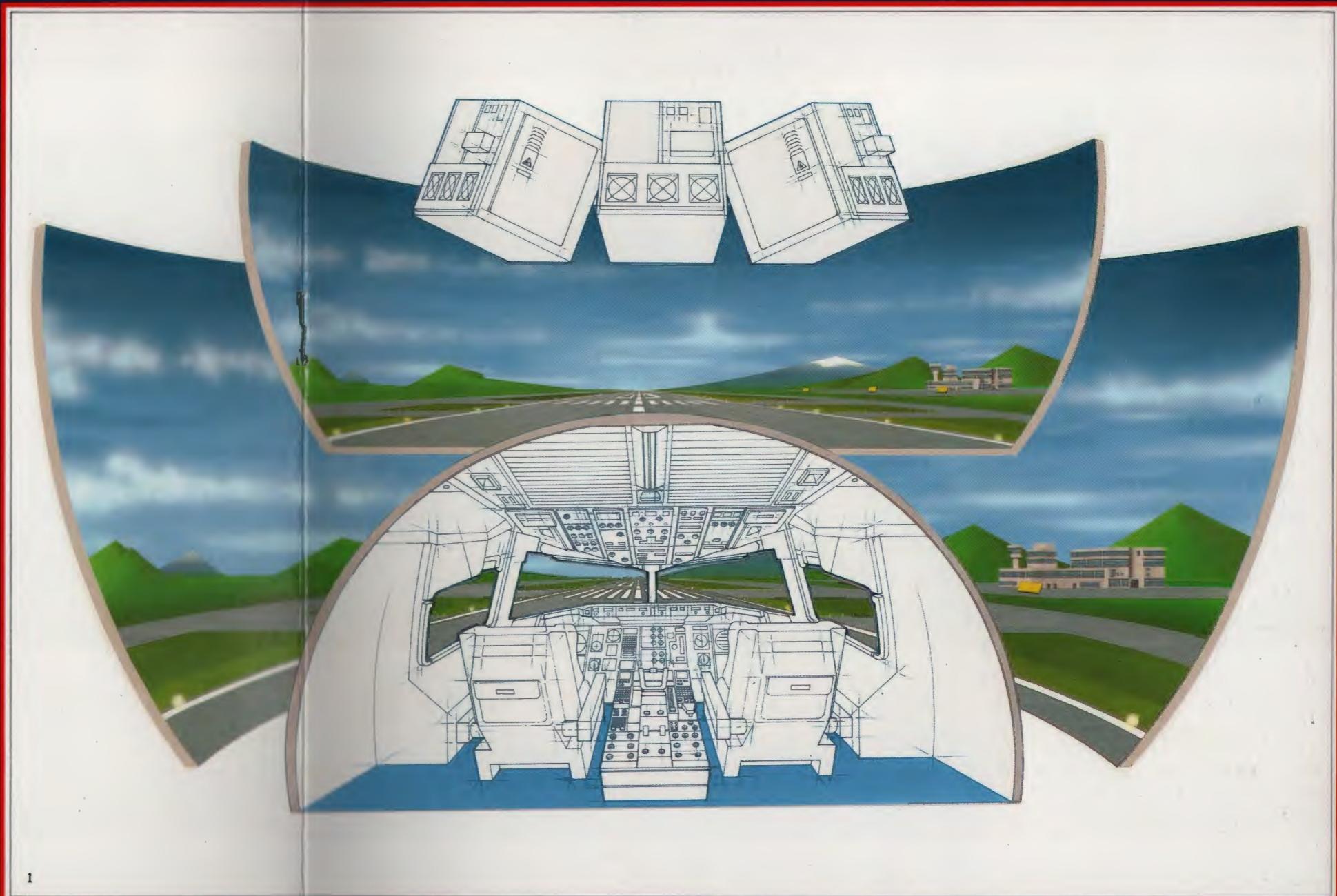
4. Five projector WIDE II creates a continuous 200° horizontal field of view.

New SupraWIDE projector tube



Advanced features include the spherical mirror being made as part of the tube enclosure (1) thus increasing mirror area by 40%. The phosphor target (2), mounted on the vacuum face-plate, increases target area by 35% with consequent reduction in image magnification.

The incorporation of a twin element lens (3) provides consistency of resolution across the scene right to the picture boundary.



Proven benefits and reliability

WIDE systems have now been in operational service since 1982, the first application being to British Airways Helicopters' BV234 Chinook flight simulator, and have amassed many thousands of training hours.

In doing so, the realism, which the system brings to the overall training environment, has won praise from pilots and instructors alike whilst operational reliability has been outstanding.

According to Alitalia, the first airline to specify a second WIDE, the system "quite simply improves training quality".

At Delta Air Lines, the first US operator of WIDE on its B737-200 flight simulator, very high levels of pilot acceptance are reported with the comment that there is no negative training associated with pilots compensating for the lack of realism of monitor based systems.

At the same time, WIDE has been gaining the certifications from the international regulatory bodies that allow the highest levels of training to take place.

Such credits include the highest ever achieved for commercial helicopter pilot training, gained under the UK Civil Aviation Authority regulations and, on fixed wing aircraft, FAA Phase II which allows transition training from one aircraft type to another totally in the simulator.

In engineering and maintenance terms, WIDE's performance in service has also been impressive achieving consistently high availability for training and minimal unscheduled downtime. Installed on Singapore Airlines B747-300 flight simulator WIDE, linked to a Novoview SP3/T image generator, has demonstrated a higher in-service reliability than conventional monitor based systems.

Now, as part of Rediffusion's product improvement programme, a development code named SPHERE - Spherical Reference Equipment - has been introduced to facilitate even further

WIDE set up and calibration. SPHERE is a standard feature of SupraWIDE and WIDE II and is a retrofittable option to basic WIDE systems.

Like the best engineering innovations, its strength is its simplicity. SPHERE consists of a special 35mm projector mounted, with the WIDE projectors, above the simulator cab and incorporating a very wide angle lens. In set up mode it projects, from a slide, a specially designed and predistorted test pattern onto the back projection screen. The test pattern is identical to that of the image generator so that, when the two are overlaid and precisely lined up, the edge matching and geometry of the system is fully assured.

In operation, SPHERE provides a cost effective alternative to complex, and time consuming, set up procedures using a line of sight gauge.

With such improvements WIDE has now become the flight simulator display by which all others are judged. It has undergone, and will continue to undergo, constant product development to meet even greater cost/performance goals - all this at a time when competitive systems struggle to achieve demonstrable credibility.

Whether or not WIDE is the single most important development in flight simulation technology this decade is debatable. One fact, however, remains beyond question - nothing, since the introduction of the earliest television based visual systems of the 1960s, has done more to increase the realism of the simulated training environment than Rediffusion's WIDE.

1. SPHERE is a new development designed to radically improve the ease with which WIDE systems may be set up and calibrated.

2. Alitalia is the first to order a second WIDE for an additional Super-80 simulator.

3. JAL's B767 is the first WIDE simulator to gain JCAB certification.

4. WIDE installed on Helikopter Service Super Puma simulator at Stavanger.



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WIDE Systems Summary

WIDE display characteristics

- Continuous uninterrupted field-of-view, 150°, 180° and 200° horizontal by 40° vertical.
- Continuous, collimated, full colour display viewable from anywhere within the cockpit.
- Inherent immunity to spurious reflections permits use of high cockpit ambient light levels under day conditions.
- SupraWIDE uses advanced CRT design producing minimal variation of resolution across the field-of-view.
- Signal input allows compatibility with calligraphic, raster scan, or hybrid image generators.
- Simplicity of design ensures high reliability, minimal maintenance and low cost of ownership.
- Meets all current international regulatory requirements up to FAA Phase III and equivalent.

SupraWIDE display specification

Field-of-view	150° horizontal × 40° vertical from 3 channels, biased vertically +25°, -15° or +20°, -20° or +15°, -25°
	180° horizontal × 40° vertical from 4 channels, biased vertically +15°, -25° horizontally +70°, -110° or +110°, -70°
	200° horizontal × 40° vertical from 5 channels, biased vertically +15°, -25° (5 projector display allows optional use with 4 channel switchable image generator)
Resolution	3 arc minutes light points 3 arc minutes surfaces
Brightness	White highlight brightness 9ft lamberts
Contrast Ratio	Lightpoints 30:1 Surfaces 20:1
Weight	3000lb including projectors
Size	21ft × 12ft × 20ft width, height, length

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